European Scientific Journal September 2013 edition vol.9, No.25 ISSN: 1857 – 7881 (Print) e - ISSN 1857- 7431

IS KENYA'S CURRENT ACCOUNT SUSTAINABLE? A STATIONARITY AND COINTEGRATION APPROACH.

Nyongesa N. Destaings, MA
Mukras S. Mohamed, PhD
Momanyi Gideon, PhD
Department of Economics Maseno University, Kenya.

Abstract

The objective of this paper is to examine the sustainability of the current account deficits in Kenya. In this respect, stationarity and Cointegration test was employed to ascertain sustainability of the current account in Kenya between 1970 to 2012.The choice of the set of variables were motivated by the existing theories about the long-run intertemporal budget constraint. Results indicate that Current account is stationary at levels implying that its mean reverting and temporary and that external debt is finite and sustainable. The empirical results suggest that exports and imports are cointegrated with the cointegrating coefficient of 0.21989 which is significantly not equal to one, but equal to zero, implying that the current account was not on the sustainable path indicating a weak form of sustainability. The paper concludes that Current account deficit of Kenya may not be sustainable in the long-run.

Keywords: Current account Deficit, sustainability, stationarity, Cointegration

1. Introduction

Current account disequilibrium is one of the most discussed issues in the area of economics and econometrics in recent times. Most of the analysis indicates that the current account is an indicator of changes in national net indebtedness. Current account sustainability, is an issue of significant importance for policymakers and academic economists alike (Holman, 2001; Mann, 2002).

The large and persistent current account deficits are among the most serious problems of many developing countries since they result in economic crises like currency crises, the burgeoning external debts and the reduction in

international reserves. The persistent growth of current account deficits in both developed and developing countries has raised questions about their potential excessiveness and concerns regarding the potential impact and disorderly correction that may result from these imbalances.

Kenya has one of the Africa's worst performing economies, notwithstanding a pick up economic growth in some past years. The economy is market based, with some state owned infrastructure enterprises and maintains a liberalized external trade system. Kenya's current account has and continues to witness persistent deficit.

In the first decade after independence, Kenya's economy grew at impressive rates, with GDP expanding by 6.6 percent. A series of exogenous factors compounded by inadequate macroeconomic policy responses reversed the impressive economic growth of the first decade. The current account deficit rose from 2.9 percent of GDP over 1964-73 to 6.9 percent over 1974-79 on account of the two oil shocks, widening trade balance and overvalued domestic currency. Long term flows turned from a position of 5 percent of GDP over 1964-73 to a -1.8 percent of GDP over 1996-2000 prompting the country to rely increasingly on risky short term flows to balance the accounts. Monetary movements have been negative indicating a week foreign exchange reserves position.

Compounded with the recent world economic slowdown, the significance of such perpetual current account deficit may pose a threat to long term economic growth, (GOK 2009). The current account deficit persistency may have implication of an excess of investment demand over savings with the dangerous consequences of balance of payment crises, debt accumulation and the reduction in the level of international reserves.

According to Nyongesa (2007) and Nyongesa and Onyango (2009,2012), while using both cointegration and Granger causality methodology found out that current account deficit was the cause of budget deficit in Kenya. This implied that parsimoniously external deficit is very crucial to the current stability of the economy, ceteris paribus.On the other hand the large external deficit will not be financed by foreigners. At some point, there will inevitably have to adjust back to payments balance. It is thus not only important to know the sources of the current account deficit, but also the size and time profile of the balancing adjustments. That makes long term sustainability of the current account deficit a bench mark of which authorities should be aware, as it could assist in predicting threats to macroeconomic sustainability.

Measuring current account sustainability has been a contentious issue (Holman, 2001, Mann, 2002).The recent developments in time series techniques, notably tests for stationarity and cointegration, allow for econometric testing of the sustainability hypothesis. The current account

stationarity is vital for two reasons. First, a stationary current account is consistent with the sustainability of the current account, and hence is an indication that a country will not default on its international debt. Second, the Stationarity of current account agrees with the implication of the modern intertemporal approach to the current account and thus supports its validity (Obstfeld and Rogoff, 1996).

This paper attempts to provide an in-depth empirical analysis on the sustainability of current account imbalances for Kenya. To research this problem, we draw on the recent development of the classical unit root tests of Dickey and Fuller (1979, 1981),Said and Dickey (1984) and Phillips and Perron (1988) non parametric test and the second generation stationarity test technique of Elliot, Rothenberg and Stock (1996) and KPSS test of Kwiatkowski *et al*. (1992). In addition, we examine the long-run relationship between the using the method of Johansen and Juselius (1990) are adopted.

2. Literature Review

Milesi-Ferreti and Razan (1996) developed a framework of current account sustainability. They point out that persistent current account deficits of 5 per cent of GDP for 3 – 4 years do not necessarily mean that the deficit is sustainable. Their main argument is that the "sustainable" level of a current account deficit is the level consistent with solvency. This is the level at which the external debt to GDP level stabilize. One of the major conclusions of the study by Milesi-Ferreti and Razan is that the current account deficit should "flash a red light" if the export sector is very small, external debt and debt service costs are too high, savings are low and the financial sector is poorly regulated.

Bodman (1997) examines the dynamic relationship between Australian imports and exports in both the short and long-run using recent cointegration and error correction techniques. The study analyses the direct implications over the specification and estimation of Australian import and export functions and resulting elasticity estimates. The authors also addresses the issue of sustainability of persistent current account deficits in the Australian context and provides a test of whether Australia is satisfying its intertemporal (or present value) budget constraint (IBC). The results indicate that exports and imports are all integrated of order one I(1) and that exports and imports are cointegrated, suggesting a long-run equilibrium relationship between them despite apparent short-term divergences. It is shown that Australia satisfies both necessary and sufficient conditions to satisfy its present value budget constraint. Therefore the Australian current account deficit is sustainable.

Baharumshah, Lau and Fountas (2003) examine the sustainability of the current account imbalance for four ASEAN countries (Indonesia, Malaysia, the Philippines, and Thailand) over the 1961–1999 periods. They

we utilize the intertemporal budget constraint (IBC) model to explain the behavior of the current account in these countries. The analysis is based on unit root and cointegration procedures including those allowing for a structural break to deal with the major shortcomings of previous studies. The empirical results indicate clearly that for all countries, except Malaysia, current account deficits were not on the long-run steady state in the pre-crisis (1961–1997) era. This leads us to conclude that the current accounts of these countries were unsustainable and did not move towards external-account equilibrium. Moreover, the persistent current account deficits might serve as a leading indicator of financial crises. In contrast, we find strong co-movement between inflows and outflows in Indonesia, the Philippines, and Thailand in the period including the post-crisis years, while Malaysia was on an unsustainable path. This is because macroeconomic performance of most of the ASEAN-4 countries has changed dramatically since the onset of the Asian crisis in mid-1997. The evidence suggests that action to prevent large appreciations should have been taken prior to the 1997 crisis.

Baharumshah, Lau, and Fountas (2004) attempt to examine the issue of sustainability of current account imbalances in eight East Asia countries in the panel and can be broadly divided into the crisis-affected economies (Indonesia, Malaysia, the Philippines, South Korea, and Thailand) and the non-affected economies (Japan, Taiwan, and Singapore), using the latest developments in nonstationary panel data analysis. The methods of nonstationary time series panels provide a much more promising explanation than would an analysis based on pure time series or cross section data. The empirical results clearly indicate that the current account imbalances were not on the long-run steady state in the pre-crisis era (1970-1997). This leads to the conclusion that the current accounts of Asia-8 during this period were unstable and did not move towards external account equilibrium. However, strong co movements between exports and imports are found in the extended sample period that includes the post-crisis period (1970-2000). This result implies that large currency depreciations and the economic recovery have brought the Asia-8 economies back on a sustainable path. Thus, current account imbalances may be used as an indicator (or warning signal) in predicting future crises.

Muwanga-Zake and Katamba (2005) analyzes the composition, magnitudes and trends of capital flows and current account deficit in Uganda over the 1994- 2004 period. The results reveal that the pattern of capital flows fluctuated over the period mainly on account of official flows, the basis on which the magnitude of Uganda's external debt stock grew substantially during the period. Private capital flows also increased steadily over the period, with the bulk being in the form of foreign direct investment that appeared to be more stable than other identified flows. Additionally,

these flows appeared to have provided some impetus for positive and significant growth in output. However, the current account deficit excluding grants proved to be consistently large. The size of the deficits seemed to suggest that it might continue to remain unsustainable in the medium term. This is because total imports tended to grow at a faster rate compared to exports of goods, hence inducing a sustained widening of the current account gap that has translated into a form of a chronic imbalance.

Matsubayashi (2005) re-examines whether the huge external deficits in the United States for the last few decades are sustainable by using time series methods. Two distinct analytical differences from earlier works are considered. First, the private sector and government are separated to construct the current account identities used in this paper. Second, both the necessary and sufficient conditions for the sustainability of external deficits are explicitly considered. Taking these modifications into consideration, the empirical results of this study do not necessarily reject the hypothesis that external deficits in the US are sustainable.

The study examined the main macroeconomic, financial and structural factors that shaped current account developments in Greece over the period from 1960 to 2007 and discuss these developments in relation to the issue of external sustainability. Concerns over Greece's external sustainability have emerged since 1999 when the current account deficit widened substantially and exhibited high persistence. The empirical model used, which theoretically rests on the intertemporal approach, treats the current account as the gap between domestic saving and investment. The authors examined the behavior of the current account in the long run and the short run using co-integration analysis and a variety of econometric tests to account for the effect of significant structural changes in the period under review. The findings indicate that a stable equilibrium current account model can be derived if the ratio of private sector financing to GDP, as a proxy for financial liberalization, is included in the specification. Policy options to restore the country's external sustainability are explored based on the estimated equilibrium model, (Brissimis, *et al* 2010).

Sustainability indicators have been proposed, by which an acceptable level of current account deficit that the country can bear without endangering its solvency position. In this respect, some sustainability criteria have been developed and these are used as indicators for the crises. Studies have used the econometric techniques such as unit roots and cointegration analyses in order to evaluate the notion of sustainability. A common feature in existing literature is the finding of nonstationary current accounts using unit root tests such as Wu (2000) for Organization of Economic Cooperation Countries (OECD). Another approach is to examine the cointegration between exports and imports such as Leachman and Francis (2000) and Wu, Chenn and Lee

(2001) for Group of Seven Countries, (G7). There are also some studies that apply both methodology such as Baharumshah, Lau and Fountans (2003) and Ongan (2008).

The large current account deficits in Kenya raise the issue of whether these deficits are sustainable. The financial crises of the 1990s (including those of the East Asia) demonstrate that a large current account deficit may trigger a sharp hike in interest rates, a rapid depreciation of exchange rates and hence may disrupt the performance of the domestic economy for example the Mexican crisis of 1994-95 was similarly preceded by a very large current account deficit. Thus there is need to empirically determine the sustainability of the Kenya's current deficit.

3. Theoretical models

3.1 Current Account Stationarity Theory

From a simple theoretical framework with the infinitely-lived, consumption-smoothing representative agent, the theoretical predictions on the current account sustainability can be made (Trehan and Walsh, 1991; Hakkio and Rush, 1991). Stationarity of current account balances is warranted as the representative agent optimizes her consumption with the long-run intertemporal budget constraint (LRBC).

When we assume that the economy-wide budget constraint is given as:

$$C_t + I_t + G_t + B_t = Y_t + (I + r_t)B_{t-1} \quad (1)$$

where C_t, I_t, G_t , B_t , Y_t , and r_t represent consumption, private investment, government spending, net foreign assets, output, and the world real interest rate, respectively. We can

The net foreign asset can be isolated as:

$$B_t = (I + r_t)B_{t-1} + Y_t - C_t - I_t - G_t \quad (2)$$

Simplifying further

$$B_t = (I + r_t)B_{t-1} + NX_t \quad (3)$$

or

$$CA_t = r_t B_{t-1} + NX_t \quad (4)$$

where $Y_t - C_t - I_t - G_t = NX_t$ .Hence the current account balance is composed of the net flow of income from the domestic economy to the rest of the world in exchange for goods and services and capital.

Following Taylor (2002), we can consider (3) at the steady state in a stochastic setting. Defining $R_t = 1 + r_t$ such that $E(R_{t+i} \mid \Omega_{t-1}) = R$ for all t and $i \geq 0$ given the information set Ω from the previous period, leads us to obtain the long-run behavior of current account as:

$$B_{t-1} = \lim_{f \to \infty} R^{-(f+1)} E(B_{t+f} \mid \Omega_{t-1}) - \sum_{f \to 0}^{\infty} R^{-(f+1)} E(NX_{t+f} \mid \Omega_{t-1}) \quad (5)$$

The LRBC is conditional on:

$$\lim_{f\to\infty} R^{-(f+1)}E(B_{t+f}\mid\Omega_{t-1})=0 \qquad (6)$$

This condition holds as long as the world interest rate is above zero and the current account is stationary. Even when adjusted to allow for stochastic growth, the intertemporal framework yields a similar condition for sustainability. Allowing the world economy to grow at rate of g_t with $E(g_t)=g>0$, we can show that in the case with growth and stochastic shocks, the LRBC implies that;

$$\lim_{f\to\infty} \rho^{-(f+1)}E(B_{t+f}\mid\Omega_{t-1})=0 \qquad (7)$$

where $B=\frac{B}{Y}$ and $\rho_t=\frac{R_t}{g_t}$.This will hold as $\rho_t=\frac{R_t}{g_t}>1$ and the current account as a fraction of output is stationary.

3.2 The Intertemporal Theory.

This theoretical model was developed by Husted(1992) which was based on Hakkio and Rush's (1991) procedure. It is noted that an open economy faces the following budget constraint for each period *t:*

$$C_t=Y_t+B_t^f-I_t-(1+r_t)B_t^f \qquad (8)$$

where C_t is public and private consumption in period *t,* Y_t is the production in period *t.* I_t is Investment in period *t* , r_t is one period world interest rate and B_t^f is international borrowing which could be positive or negative.Since this budget constraint must be satisfied for all periods, forward iterating (8), the intertemporal budget constraint is given by;

$$B_t^f=\sum_{i=1}^{\infty}\mu_i\left[Y_{t+i}-C_{t+i}-I_{t+i}\right]_t+\underset{i\to\infty}{Lim}\,\mu_i B_t^f \qquad (9)$$

where $\mu_i=\prod_{j=1}^{i}\left(\frac{1}{1+r_{t+j}}\right)$ is a product of the first *i* discount factors. Note that:

$$Y_t-C_t-I_t=X_t-M_t=TB_t \qquad (10)$$

where TB denotes trade balance.Therefore the economy's budget constraint can be expressed as

$$B_t^f=\sum_{i=1}^{\infty}\mu_i\left[TB_{t+i}\right]_t+\underset{i\to\infty}{Lim}\,\mu_i B_t^f \qquad (11)$$

From equation (11) when the last term vanishes the current value of the foreign debt has to equal to the sum of present discounted value of future trade balances. If the current stock of foreign debt is bigger than the present

value of future trade balances, then the country's debt is in a bubble and thus the current account is not sustainable.

Hakkio and Rush (1991) and Husted (1992) assumed a stationary world interest rate with mean r that is exogenous with respect to this economy's choices. Upon further manipulation, equation (11) can be written as

$$M_t + B_t^f = X_t + \sum_{i=0}^{\infty} \frac{\Delta X_{t+1} - \Delta Z_{t+1}}{(1+r)^{i-1}} - \underset{i\to\infty}{Lim} \frac{B_{t+1}^f}{(1+r)^{i-1}} \quad (12)$$

where $Z_t = M_t + (r_t - r)B_{t-1}^f$. Now, subtracting X_t and then multiplying both sides of the equation by minus 1, we get

$$CA_t = X_t - M_t - rB_t^f = \sum_{i=0}^{\infty} \frac{\Delta X_{t+1} - \Delta Z_{t+1}}{(1+r)^{i-1}} - \underset{i\to\infty}{Lim} \frac{B_{t+1}^f}{(1+r)^{i-1}} \quad (13)$$

Assuming that both the X and Z are both nonstationary process, each integrated of order 1 denoted by $I(1)$;

$$X_t = \alpha_1 + X_{t-1} + \varepsilon_{1t} \quad (14)$$

$$Z_t = \alpha_2 + Z_{t-1} + \varepsilon_{2t} \quad (15)$$

Where α_j are drift parameters (possibly equal to zero) and ε_{it} are stationary process and uncorrelated.For this particular case, equation (14) becomes

$$X_t = \alpha + M_t^* - \underset{i\to\infty}{Lim} \frac{B_{t+1}^f}{(1+r)^{i-1}} + \varepsilon_t \quad (16)$$

with $M_t^* = M_t - rB_{-1t}^f$ indicates imports of goods and services plus net interest payments, $\alpha = \frac{1+r}{r}(\alpha_1 - \alpha_2)$, and $\varepsilon_t = \sum_{i=0}^{\infty} \frac{(\varepsilon_{1t} - \varepsilon_{2t})}{(1+r)^{i-1}}$

Assuming that the second term in equation (16) vanishes, then (14) can be written as a simple regr ession relation

$$X_t = \alpha + \beta M_t^* + \varepsilon_t \quad (17)$$

where under the normal hypothesis that the economy is satisfying the intertemporal budget constraint, we expect the $\beta = 1$ and ε_t would be stationary. Thus if X_t and M_t^* are $I(1)$, then they are cointegrated.

The empirical results may allow establishing several conclusions concerning the sustainability of the intertemporal budget constraint;

i) When there is no cointegration the current account is not sustainable and do not move towards external-account equilibrium.
ii) When there is cointegration with $\beta = 1$,the current account is sustainable;

iii)When there is cointegration with $\beta > 1$,the economy's imports are growing faster than the economies exports, and the current account may not be sustainable.

The condition $0 < \beta < 1$ is a sufficient condition for the budget constraint to be obeyed. However, when imports and exports are expressed as a percentage of gross domestic product or in per capita terms, it is necessary to have $\beta = 1$ in order for trajectory of debt to GDP not to diverge in an infinite horizon.

4. Econometric Methodolgy

In this section a discussion of the methodology of unit root/stationarity and cointegration tests is provided. In order to test the order of integration of the macroeconomic series, the study employed a battery of stationarity tests including classical unit root tests namely the Augmented Dickey-Fuller (ADF) test and the Phillips Perron (PP) test and the second generation tests proposed by Elliot, Rothenberg and Stock (1996) were used. The tests were confirmed by the KPSS test of Kwiatkowski *et al*. (1992).

4.1 Unit Root and Stationarity Test

4.1.1 Augmented Dickey-Fuller (ADF) test

While testing the unit root using the ADF test, the study used the following ordinary least square equations:

$$\Delta y_t = \delta y_{t-1} + \alpha_i \sum_{i=1}^{\rho} \Delta y_{t-i} + \varepsilon_t \qquad (18)$$

$$\Delta y_t = \beta_1 + \delta y_{t-1} + \alpha_i \sum_{i=1}^{\rho} \Delta y_{t-i} + \varepsilon_t \qquad (19)$$

$$\Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \alpha_i \sum_{i=1}^{\rho} \Delta y_{t-i} + \varepsilon_t \qquad (20)$$

For all the $\varepsilon_t \sim IId(0, \sigma_\varepsilon^2)$

The difference between the three regressions equations 18, 19 and 20 concerns the presence of the deterministic elements δ and α_i . The first is a pure random walk model, the second adds an intercept or drift term, and the third includes both a drift and linear time trend. In all cases the null hypothesis is that the tested time series variable contains a unit root.

However, there is a question concerning whether it is most appropriate to estimate Equation 18,19, or 20 unless the researcher knows the actual data-generating process. It might seem reasonable to test the hypothesis using the most general form of the models, namely Equation 20.

4.1.2 Phillips Perron (PP) test

It has been proved, using Monte Carlo simulation that the power of the ADF test is very low. The ADF test is unable to discriminate clearly

between nonstationary and stationary series with a higher degree of autocorrelation and is sensitive to breaks. To overcome this, the semi-parametric Phillips-Perron test which gives robust estimates when the series has serial correlation and time dependent heteroscedasticity will be used to supplement the ADF test.

Phillips and Perron (1988) propose an alternative (nonparametric) method of controlling for serial correlation when testing for a unit root. The PP method estimates the nonaugmented DF test equation (3.14c), and modifies the t-ratio of the α_i coefficient so that serial correlation does not affect the asymptotic distribution of the test statistic. The PP test is based on the statistic:

$$\tilde{t}_\alpha = t_\alpha \left(\frac{\gamma_0}{f_0} \right)^{1/2} - \frac{T(f_0 - \gamma_0)(se(\tilde{\alpha}))}{2 f_0^{1/2} s} \qquad (21)$$

where $\tilde{\alpha}$ is the estimate and t_α is the t-ratio of α_i, $se(\tilde{\alpha})$ is the coefficient standard error and s is the standard error of the test regression. In addition γ_0 is the consistent estimate the error variance in (3.16) [calculated as $(T-k)s^2/T$ where k is the number of regressors].The remaining term f_0 is an estimator of the residual spectrum at frequency zero.

The ADF and PP tests are asymptotically equivalent but may differ substantially in finite samples due to the different ways in which they correct for serial correlation in the test regression. Thus the ADF and PP tests are severely size distorted (reject I(1) null much too often when it is true) and that the PP tests are more size distorted than the ADF tests. In general, the ADF and PP tests have very low power against I (0) alternatives that are close to being I(1). That is, unit root tests cannot distinguish highly persistent stationary processes from nonstationary processes very well. Also, the power of unit root tests diminish as deterministic terms are added to the test regressions. That is, tests that include a constant and trend in the test regression have less power than tests that only include a constant in the test regression. For maximum power against very persistent alternatives the recent tests proposed by Elliot, Rothenberg and Stock (1996) were used. The tests were confirmed by the KPSS test of Kwiatkowski *et al*. (1992).

4.1.3 Dickey-Fuller Test with GLS Detrending (DF-GLS)

ERS (1996) proposed a simple modification of the ADF tests in which the data are detrended so that explanatory variables are “taken out” of the data prior to running the test regression. ERS define a quasi-difference of y_t that depends on the value a representing the specific point alternative against which we wish to test the null:

$$d(y_t \mid a) = \begin{cases} y_t & if \quad t = 1 \\ y_t - a y_{t-1} & if \quad t > 1 \end{cases} \tag{22}$$

Considering an OLS regression of the quasi-differenced data $d(y_t \mid a)$ on the quasi-differenced $d(x_t \mid a)$:

$$d(y_t \mid a) = d(x_t \mid a)\hat{\delta}(a) + \eta_t \tag{23}$$

where x_t contains either a constant, or a constant and trend, and let $\hat{\delta}(a)_t$ be the OLS estimates from this regression. ERS recommend the use of $a = \bar{a}$, where:

$$\bar{a} = \begin{cases} 1 - 7/T_t & if \quad x_t = \{1\} \\ 1 - 13.5/T & if \quad x_t = \{1, t\} \end{cases} \tag{24}$$

Defining the *GLS detrended data,* y_t^d using the estimates associated with the $\bar{a}$:

$$y_t^d = y_t - x_t' \hat{\delta}(\bar{a})$$

Then the DFGLS test involves estimating the standard ADF test equation, (20), after substituting the GLS detrended y_t^d for the original y_t . While the DFGLS -ratio follows a Dickey-Fuller distribution in the constant case, the asymptotic distribution differs when you include both a constant and trend.

4.1.4 The Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) Test

The KPSS (1992) test differs from the other unit root tests described here in that the series is assumed to be (trend-) stationary under the null hypothesis. The KPSS statistic is based on the residuals from the OLS regression of y_t on the exogenous variables x_t .

$$y_t = x_t' \delta + u_t \tag{25}$$

The LM statistic is defined as:

$$LM = \sum S(t)^2 / (T^2 \, fo) \tag{26}$$

where *fo* , is an estimator of the residual spectrum at frequency zero and where $S(t)$ a cumulative residual function is:

$$S(t) = \sum_{r=1}^{t} \hat{u}_r \tag{27}$$

based on the residuals $\hat{u}_t = y_t - x_t' \delta(0)$. We point out that the estimator of δ used in this calculation differs from the estimator δ for used by GLS detrending since it is based on a regression involving the original data and not on the quasi-differenced data. To specify the KPSS test, you must specify the set of exogenous regressors x_t and a method for estimating *fo* .

The reported critical values for the LM test statistic are based upon the asymptotic results presented in KPSS

4.2 Cointegration Test

In order to test the sustainability of the current account deficit the study adopted the Cointegration test of Johansen (1988) and Johansen and Juselius (1990) maximum likelihood estimator. According to the multivariate model of Johansen and Juselius (1990), the vector autoregressive (VAR) is estimated as;

$$X_t = \Pi_1 X_{t-1} + \Pi_2 X_{t-2} + ... + \Pi_k X_k + \phi D_t + u_t \qquad (28)$$

where $\prod_t, \phi$ are ($n \times n$) matrix of parameters, u_t is assumed to be independent and Gaussian distributed with mean zero and variance σ^2 ,thus $u_t \sim IId(0, \sigma_u^2)$.

The variable D_t contains deterministic terms such as constants and a linear trend and where X_t is (X_t, M_t) and an ($n \times 1$) vector consisting of exports and imports for the sustainability modeling integrated of $I(1)$.

The long-run equilibrium is $\prod X = 0$, where the long-run coefficient matrix $\prod$ is defined as

$$\prod_i = I - \prod_1 - \prod_2 - ... - \prod_k \qquad i = 1,2,...k \qquad (29)$$

The long-run cointegrating matrix $\prod$ is an *N* x *N* matrix whose rank determines the number of cointegrating vectors, say r . If we define two matrices $\alpha(N \times p)$ and $\beta(N \times p)$ such that $\prod = \alpha\beta^T$, the row of β consists r cointegrating vectors. The study used both the maximum-eigenvalues method and trace tests statistics introduced by Johansen and Juselius (1990) in determining the number of cointegrating vectors.

4.3 Data Description

This study was based on annual time series data of the variables Current account balance, Exports and Imports as a percentage of GDP for the period 1970-2012 for Kenya. It should be noted that in 1970s is when Kenya started experiencing acute current account deficits. All the data were gathered from various issues of World Bank database.

5. Results and Discussions

5.1 Descriptive statistics

To assess the distributional properties of current account, export and import variables descriptive statistics are reported in Table 1.As shown in table .1, the average current account balance (CA) has mostly remained in negative territory for a large sample of Kenya's data, this indicates that the deficits is a persistent feature of Kenyan economy. Using the data for the period 1970-2011, the average current account deficit as a ratio to GDP is

5.6%, it can also indicates that CA has surpassed more than ten times the threshold set by Mann (1999) of 5%, this result would make one to say that the current account deficit is unsustainable.In terms of the specific components of the current account, figure 1 indicates that imports (IM) have always exceeded exports (EX).

Table 1: Descriptive statistics of the variables

	CA	EX	IM
Mean	-5.6287	27.1505	32.9255
Median	-5.1345	26.7050	31.7400
Maximum	0.8885	38.9000	45.8600
Minimum	-18.6798	20.1700	26.4000
Std. Dev.	4.9803	4.1520	4.3857
Skewness	-1.1040	0.8120	0.8303
Kurtosis	3.7087	3.6947	3.3659
Jarque-Bera	9.4105	5.4610	5.0603
Probability	0.0090	0.0652	0.0796
Sum	-236.4060	1140.320	1382.870
Sum Sq. Dev.	1016.950	706.7990	788.6170
Observations	42	42	42

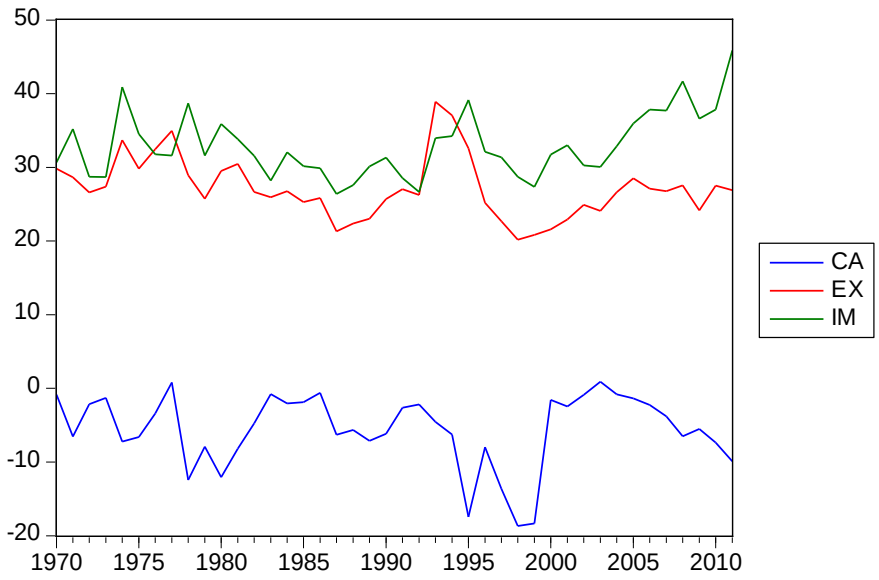

Figure 1:Time series Plot for CA,EX and IM

5.2 Unit root and Stationary tests

In order to determine the order of integration of all the series, the study employed a battery of stationarity tests including classical unit root (first generation tests) tests namely the Augmented Dickey-Fuller (ADF) test and the Phillips Perron (PP) test. Since these tests cannot distinguish between unit root and near unit root stationary processes, the study also used other stationarity (second generation) tests; these included the Dickey-Fuller Generalized Least Square (DF GLS) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test of Kwiatkowski *et al*. (1992).

The results for ADF and PP test for different models and lag lengths (determined automatically by SIC) with Null hypothesis that the series has a unit root are presented in table 1. To confirm the results of unit root, the study tested the stationarity of the variables by use of DF- GLS and KPSS tests for different models and lag length. Overwhelmingly, the test results reported in Table 2 suggest that there CA is stationary at levels that is it is integrated of order zero denoted by $I(0)$ and EX and IM are intergrated of order one [$I(1)$] for the sample period.

Table 2: Unit Root/Stationarity Test

	ADF Test		PP Test		DF-GLS test		KPSS Test		Inference
Variable	Intercept	Intercept with Trend	Intercept	Intercept with Trend	Intercept	Intercept with Trend	Intercept	Intercept with Trend	
				Level					
CA	-3.6682** (0.0084)	-3.6274** (0.0397)	-3.6682** (0.0084)	-3.6274** (0.0397)	-3.3837**	-3.6020**	0.0789**	0.0616**	*I(0)*
EX	-2.8712 (0.0575)	-2.9474 (0.1591)	-2.9757 (0.0457)	-2.9473 (0.1591)	-2.7645	-3.0283	0.2196	0.0521	
IM	-2.9218 (0.0515)	-3.2158 (0.0955)	-2.7746 (0.0708)	-3.0991 (0.1200)	-2.9885	-3.3802	0.2928	0.1717	
				First Difference					
ΔCA	- 8.1917** (0.0000)	-8.0808** (0.0000)	-8.7363** (0.0000)	-8.5963** (0.0000	-6.5089	-7.7535	0.1112	0.1107	
ΔEX	-6.3615** (0.0000)	-6.2781** (0.0000)	-6.3846** (0.0000)	-6.2939** (0.0000)	-6.3144**	-6.4236**	0.0440**	0.0391**	*I(1)*
ΔIM	-8.4250** (0.0000)	-8.4836** (0.0000)	-11.4576** (0.0000)	-20.0177** (0.0000)	-6.3300**	-7.9909**	0.5000**	0.4878**	*I(1)*

The values in the parenthesis are probabilities found from the critical values by MacKinnon (1996) Maximum lag length chosen using SIC; *indicates stationarity at 1%,** indicates stationarity at 5%,*** indicates stationarity at 10%,

For KPSS: Null Hypothesis is that the series is stationary. The asymptotic critical values are tabulated in KPSS table.

In the KPSS case we compare the test statistic value with the critical value on desired significance level. If the test statistic is higher than the critical value, we reject the null hypothesis and when test statistic is lower than the critical value, we cannot reject the null hypothesis.

The existence of stationarity to the current account as percentage of GDP is a sufficient condition for the long-run intertemporal budget constraint (LRBC) to hold, (Trehan and Walsh 1991, Taylor 2002). This has vital economic policy implications. Firstly, the results indicate that the CA is mean reverting, it is temporary in nature and that policy reforms are useful in addressing or containing the adverse changes in the deficit, secondly, current account stationarity implies that external debt is finite and sustainable (Trehan and Walsh, 1991).To confirm this results the study runs cointegration between exports and imports as a ration of GDP for the same sample period in the next section. The existence of unit roots or Integrated of order one denoted by *I(1)* in the IM and EX time series is expected as the economic theory suggests unit root in the levels of these variables.

5.3 Johansen Cointegration Test

The study has adopted the Johansen multivariate cointegration procedure. The analysis technique has advantages over the other methods because it does not suffer from a normalization problem and is robust to departures from normality (Gonzalo, 1994); it also supports the superior properties in relation to other techniques. The optimality of the Johansen estimation has been shown by Phillips (1991) in terms of symmetry, unbiasedness and efficiency property.The determination of the number of cointegrating vectors is based on the use of two test statistics, namely the trace test and the maximum eigenvalue test, the results are reported in table 3.

Table 3: Unrestricted Cointegration Rank Test (Maximum Eigenvalue and Trace Test)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.348376	14.56180	14.26460	0.0449	17.95428	15.49471	0.0209
At most 1	0.094962	3.392480	3.841466	0.0655	3.392480	3.841466	0.0655

Max-eigenvalue and Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The comparison of test statistics with the critical values provides evidence for cointegration or long run relationship between exports and imports for Kenya in the sampled period. Johansen cointegration analysis requires the determination of appropriate lag length with an unrestricted VAR model. The log likelihood object provides a general, open-ended tool for estimating a broad class of specifications by maximizing likelihood function with respect to parameters. In relation to log likelihood the study used the AIC lag specification criterion. The coefficients of the cointegrating vector are given in Table 4.

Table 4 : Normalized Cointegrating Coefficients and Adjustment Coefficients

	EX	IM
Normalized cointegration coefficient	1.0000	-0.21989
		(0.37266)
	D(EX)	D(IM)
Adjustment Coefficient	-0.8999	-0.66755
	(0.34551)	(0.28953)

Log likelihood -151.5932, standard error in parentheses, Lags interval (in first differences): 1-7,

While the existence of a cointegration relationship between imports and exports is a necessary condition to sustain the foreign deficit, it is not an enough condition. Along with the existence of a cointegration relationship between imports and exports the slope coefficients obtained from the equations derived from these series should also be equal to 1 to put forth clearly that the foreign deficit is sustainable. Failure to fulfill the second condition (sufficient condition) in Kenyan case requires that the sustainability of foreign deficit must be considered with doubt.

The estimated β is 0.21989, which is not close to unity. The null hypotheses of $\beta = 1$ is easily rejected. While the hypothesis of $\beta = 0$ is not rejected as such, the empirical results suggest that exports and imports are cointegrated with the cointegrating coefficient less equal to 0, implying that the current account was not on the sustainable path (weak form of sustainability), we can conclude that CA of Kenya may not be sustainable in the long-run.

6. Policy Implication and Conclusions

The primary purpose of this study is to investigate empirically the sustainability of the current account in Kenya. The present study tests for the sustainability of the current account as predicted by the Stationarity and intertemporal model using panel data. The results of the analysis lead to the several interesting conclusions.

The existence of stationarity to the current account as percentage of GDP is a sufficient condition for the long-run intertemporal budget

constraint (LRBC) to hold, (Trehan and Walsh 1991, Taylor 2002). This has vital economic policy implications. Firstly, the results indicate that the CA is mean reverting, it is temporary in nature and that policy reforms are useful in addressing or containing the adverse changes in the deficit, secondly, current account stationarity implies that external debt is finite and sustainable (Trehan and Walsh, 1991).To confirm this results the study runs cointegration between exports and imports as a ration of GDP for the same sample period in the next section.

The policy implication of the findings of Cointegration relationship between imports and exports and the estimated value of coefficient being 0.21989 indicates that current account balance of Kenya may not be sustainable in the long-run because of faster rise in the Kenyan imports relative to the exports.The finding of the violation of the sufficient condition for sustainability implies that, a large and persistent current account deficit may trigger a financial crisis in the long run. In other words, the current account path may be used as an indicator to predict financial crises. Therefore, the policy implication arising from this analysis is Kenya should implement policy measures to correct their unsustainable external imbalances

References:

Baharumshah A.Z, E, Lau & S, Fountas. On the sustainability of current account deficits: evidence from four ASEAN countries. Journal of Asian Economics 14 (2003) 465–487,2003.

Baharumshah, A.Z., Lau, E. & S., Fountas. Current Account Deficit Sustainability:A Panel Approach. Department of Economics, National University of Ireland, Galway.Working Paper No. 73, 2004.

Brissimis, N.S., G Hondroyiannis, C., Papazoglou, N. T., Tsaveas & M. A. Vasardani. Current Account Determinants and external Sustainability in periods of structural change. European Central Bank, Working Paper Series No 1243, 2010.

Bodman P.M. The Australian Trade Balance and Current Account: a Time Series Perspective, International Economic Journal, 11:2, 39-57, 1997.

Dickey, D.A. & Fuller, W.A. Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, **74**:427-31,1979.

Dickey, D.A. & Fuller, W.A. The Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica*, **49**:1057-72, 1981.

Elliott, Graham, Thomas J. Rothenberg and James H. Stock."Efficient Tests for an Autoregressive Unit Root," *Econometrica* 64, 813-836,1996.

Government of Kenya, Economic Survey .Government Printer, Nairobi.2009.

Hakkio, C. S. and M. Rush. Is the Budget Deficit 'Too Large'?, *Economic Inquiry*, 29: 429-425, 1991.

Holman, J A.Is the Large US Current Account Deficit Sustainable?, *Economic Review*, Federal Reserve Bank of Kansas City, First Quarter, 5-23, 2001.

Husted, S. The emerging US current account deficit in the 1980s: a cointegration Analysis, *Review of Economics and Statistics*, 74, 159-166, 1992.

Johansen, S. Statistical Analysis of cointegrating Vectors. *Journal of Economic Dynamics and Control*, **12,**231-54, 1988.

Johansen, S. & K. Juselius. 'Maximum Likelihood Estimation and Inference on Cointegration, with Applications for the Demand for Money. *Oxford Bulletin of Economics and Statistics*, **52**:169–210,1990.

Kwiatkowski, Denis, Peter C. B. Phillips, Peter Schmidt & Yongcheol Shin. "Testing the Null Hypothesis of Stationary against the Alternative of a Unit Root," *Journal of Econometrics*, 54, 159-178,1992.

Leachman, L.L. & B.B. Francis."Multicointegration Analysis of the Sustainability of Foreign Debt". Journal of Macroeconomics. 22-2, pp. 207-227,2000.

MacKinnon, James G. "Numerical Distribution Functions for Unit Root and Cointegration Tests,"*Journal of Applied Econometrics*, 11, 601-618, 1996.

Matsubayashi, Y. Are US current account deficits unsustainable? Testing for the private and government intertemporal budget constraints Japan and the World Economy 17, 223–237,2005.

Mann, C.L. Is the US Trade Deficit Sustainable? Washington: Institute of International Economics, 1999.

Mann, C. Perspectives on the US current account deficit and sustainability, *Journal of Economic Perspectives*, 16: 131-152, 2002.

Milesi-Ferretti, G.M., & A. Razin. Current account sustainability. Princeton Studies in International Finance, 81, 1996.

Muwanga-Zake E.S. K & P.M. Katamba. Capital Flows and Current Account Sustainability – Uganda's Experience 1994-2004. Presentation to United Nation Economic Commission for Africa Workshop Capital Flows and Current Account Sustainability in African Economies, Accra, Ghana, 2005.

Nyongesa and Onyango. "Causality between Current Account Deficit and Budget Deficit in Kenya" in Mukras, Fundamentals of Time series econometrics Vol 2.Lambert Publishers,London,UK,2012.

Nyongesa D. & Onyango S.Causality between Current Account Deficit and Budget Deficit in Kenya. *African Journal of Business and Economic Research (AJBER*) Vol 4. No 2 & 3, 2009.

Nyongesa D. Causality between Current Account Deficit and Budget Deficit in Kenya. Unpublished Masters of Arts Thesis, Maseno University, Department of Economics and Business studies, 2007.

Obstfeld, M. and K. Rogoff. *Foundations of International Macroeconomics*, The MIT Press, Massachusetts,1996.

Phillips, P.C.B. and P. Perron."Testing for a Unit Root in Time Series Regression," *Biometrika*, 75, 335–346, 1988.

Said, S. & Dickey, D. Testing for Unit Roots in Autoregressive Moving Average Models with Unknown Order. *Biomettica*, **71**: 599-607, 1984.

Taylor, A. M. A century of current account dynamics. *Journal of International Money and Finance, Vol. 21* , 725-742, 2002.

Tayyaba I & Saira T. The Harberger-Laursen-Metzler Effect: Evidence from Pakistan, *The Lahore Journal of Economics* 17: 2 (Winter 2012): pp. 87-110, 2012.

Trehan, B., & Walsh, C. Testing intertemporal budget constraints: Theory and applications to U.S. federal budget and current account deficits. *Journal of Money, Credit and Banking, 23(2)* , 206-223,1991.

Wu, J. L. "Mean reversion of the current account: evidence from the panel Data Unit Root Test". Economics Letters. 66, pp. 215-222, 2000.

Wu, J. L., S. L. Chen & H. Y. Lee. "Are Current Account Deficits Sustainable? Evidence from Panel Cointegration". Economics Letters. 72, pp. 219-224, 2001.